

What is claimed is:

1. A heat-resistant diamond composite sintered body prepared by sintering an ultrafine-grain synthetic diamond powder having an average grain size of 200 nm or less, without using a sintering aid, said composite sintered body comprising a diamond crystal and a minute amount of non-diamond carbon as a product, and having a Vickers hardness of 85 GPa or more.

2. A method of producing the heat-resistant diamond composite sintered body as defined in claim 1, comprising:

enclosing a synthetic diamond powder having an average grain size of 200 nm or less, in a capsule made of Ta or Mo; and

heating and pressurizing the capsule under thermodynamically stable conditions including a temperature of 2100°C or more and a pressure of 7.7 GPa or more, by use of an ultrahigh-pressure synthesizing apparatus.